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Irrigation Scheduling for Pea in Southern Alberta

Irrigation management is about controlling the rate, amount, and timing of applied irrigation water in a planned and efficient manner. With good irrigation management, a pea crop can have high yield and quality potential.

Irrigation management

The goal of irrigation management is to use available irrigation water effectively in managing and controlling the soil moisture environment of crops to do three things: promote the desired crop response, minimize soil degradation, and protect water quality.

Proper irrigation management requires a good understanding of a number of factors:

- soil fertility (crop nutritional requirements)
- soil-water-plant relationships
- crop type
- crop sensitivity to water stress
- crop growth stages
- availability of a water supply
- climatic factors that affect crop water use such as rainfall, temperature, humidity, wind, and net radiation
- irrigation system capabilities and limitations

Equipped with such knowledge, an irrigator can develop a workable and efficient irrigation scheduling program.

Strategies

A workable and efficient irrigation management strategy should be crop-specific.

Depletion of soil water to less than 60 per cent of available can result in reduced pea yield and quality.

Crop-specific irrigation management strategies mean available water is used efficiently to meet a specific crop's water requirements for maximum water productivity.

Generally, the goal is to ensure that water is available at germination and in early development by applying light, frequent irrigations (if there is no rainfall). This method promotes vigorous growth and replenishes and increases available soil water content in the entire root zone during the pre-flowering growth stages. Such a strategy will allow modern sprinkler irrigation systems to keep up to crop demand during the peak water use period, which typically occurs during the flowering and fruit-formation growth stages.

Crop-specific irrigation management strategies are usually applied to adjust for the following differences among crops:

- effective root zones
- sensitivity to water stress
- types (cool versus warm-season)
- vulnerability to diseases at various crop growth stages
- response to soil fertility levels
- plant population/densities
- physiologic maturity (timing of last irrigation)
- potential income

Pea water needs

Pea is an annual cool-season legume crop that is well-adapted to southern Alberta's semi-arid climate. Optimal pea yields can be obtained if the crop is seeded early in the spring in order to flower before the hot summer weather conditions. A pea crop uses water for growth and cooling purposes. The water

requirement or evapotranspiration (ET) for pea depends on variety, plant architecture, growth habit, growth stage, canopy density, climatic conditions, and irrigation and crop management.

Pea grown under optimal conditions (well-fertilized, adequately inoculated, well-irrigated, well-drained soils, pest-free stand, and uniform and optimum canopy) requires from 300 to 370 mm of water per growing season in southern Alberta.

Average pea water use ranges from 0.1 mm per day soon after emergence to nearly 6 mm per day during the flowering and early pod development stages (Figure 1).

Typically, pea roots grow to an effective water extraction depth of 70 cm in a well-developed soil. Root distribution is concentrated near the surface; hence, pea obtains 70 per cent of its seasonal water from the upper 35 cm of the active root zone of 70 cm. The active root zone changes from a few millimetres at emergence to a maximum depth of 70 cm at the flowering growth stage.

Irrigation scheduling strategy

Effective pea irrigation scheduling uses soil water levels in the root zone as a measure for starting and stopping irrigations. Adequate soil water is critical for pea during the emergence, vegetative, flowering, and pod development growth stages. Ideally, soil water content in the 0 to 40-cm depth should be greater than 60 per cent of available at planting.

Pea needs to have water for germination and root development during the early stages of growth. Inadequate soil water in these early growth stages results in reduced plant populations and biomass yield, which, in turn, reduce final seed yield.

A vigorous pea stand can result if available soil moisture is not depleted to less than 60 per cent in the 40-cm root zone during the vegetative growth stages. Managing soil water in a 40-cm root zone translates to light and frequent irrigation applications during the vegetative growth stages.

Irrigation water applied during vegetative growth should meet crop water requirements and build up soil water to near field capacity in the 40 to 70-cm zone for later crop use during the peak water use period when flowering (including pod set) and yield formation (pod development and pod filling) are occurring.

In general, pea is most sensitive to inadequate soil water during the flowering and yield formation growth stages. Inadequate soil water during these stages can drastically reduce pod and seed set, resulting from flower and pod abortions.

Pea roots reach maximum extension at the flowering growth stage. To ensure that soil water is adequate throughout the root zone, the monitoring depth of the

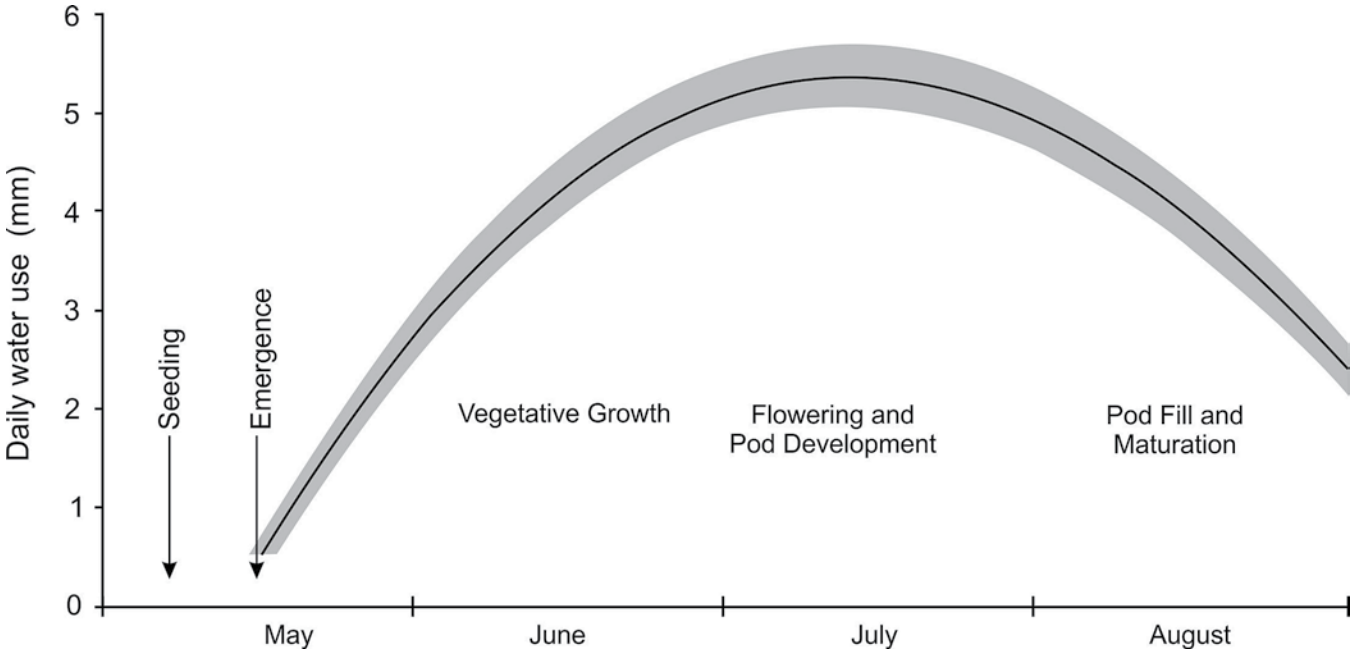

Figure 1. Daily water use during different growth stages of irrigated pea in southern Alberta. Shaded area indicates variation in pea water use depending on plant type, cultivar, and climatic conditions.

root zone should be increased from 40 cm to 70 cm at first flower appearance, and soil water should not be depleted to less than 60 per cent of available.

The availability of sufficient, good quality water to pea plants during the flowering growth stage increases the number of pods (or marketable pods for fresh markets) and seeds per pod, whereas water availability during the pod development growth stage increases the pod and seed weights.

Increasing the irrigation management root zone from 40 cm to 70 cm at the flowering growth stage requires less frequent and larger irrigation volumes and results in increased water availability to the mature pea roots. This increased time between irrigations keeps the soil surface dry, discouraging the growth of fungal diseases. Irrigation may be stopped when the pods start to ripen.

Soil texture

The irrigation amounts required to replenish the root zone once the allowable soil water depletion level is reached will vary with soil texture and growth stage, as indicated in Table 1.

Conclusion

Using suitable irrigation strategies with pea can mean a healthy crop with high yield and quality potential. In addition to ensuring that the pea crop is well-fertilized, adequately inoculated, and well-protected from pests, growers are encouraged to properly manage irrigation by regularly monitoring soil water to ensure that the availability of water does not become a limiting factor in producing a high-yielding pea crop.

Applying irrigation just before the available soil water is depleted to 60 per cent at any pea growth stage and replenishing available soil water near field capacity in appropriate root zones will greatly assist in producing a high-quality and high-yielding pea crop.

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Table 1. Soil texture-based estimation of total available water and water amounts per irrigation event for pea during vegetative, flowering, pod development, and pod fill growth stages

Soil texture	Vegetative growth stages		Flowering, pod development, and pod fill growth stages	
	Field capacity available water in a 40-cm root zone (mm)	Water required to replenish soil to field capacity at 40% allowable depletion (mm)	Field capacity available water in a 70-cm root zone (mm)	Water required to replenish soil to field capacity at 40% allowable depletion (mm)
Loamy sand	46	**18**	80	**32**
Sandy loam	56	**22**	98	**39**
Loam	72	**29**	126	**50**
Sand clay loam	61	**24**	106	**42**
Silt loam	80	**32**	140	**56**
Clay loam	80	**32**	140	**56**
Silty clay loam	88	**35**	154	**62**
Sandy clay	69	**28**	120	**48**
Silty clay	85	**34**	148	**59**
Clay	77	**31**	134	**54**

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